

1 **CLAIMS**

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3 **1.** An electromagnetic lens comprising:

4 an input section including a plurality of input probes and a curvilinear input

5 reflector;

6 an output section including a plurality of output probes and a curvilinear

7 output reflector; and

8 a coupling section including a coupling slot and a curvilinear coupling wall.

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10 **2.** The electromagnetic lens as recited in claim 1, wherein the

11 curvilinear input reflector comprises a non-circular conic section, the curvilinear

12 output reflector comprises a linear section, and the curvilinear coupling wall

13 comprises a parabolic section.

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15 **3.** The electromagnetic lens as recited in claim 2, wherein the parabolic

16 section of the curvilinear coupling wall is concave.

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18 **4.** The electromagnetic lens as recited in claim 2, wherein the coupling

19 slot comprises a parabolic section.

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21 **5.** The electromagnetic lens as recited in claim 2, wherein the non-

22 circular conic section of the curvilinear input reflector comprises at least one of a

23 hyperbolic section, an elliptical section, and a parabolic section.

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1 6. The electromagnetic lens as recited in claim 5, wherein the non-
2 circular conic section is at least one of convex and concave.

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4 7. The electromagnetic lens as recited in claim 1, wherein the
5 curvilinear input reflector comprises a multi-foci extrapolated curved section, the
6 curvilinear output reflector comprises an extrapolated curve section that is related
7 to the multi-foci extrapolated curved section of the curvilinear input reflector, and
8 the curvilinear coupling wall comprises a linear section.

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10 8. The electromagnetic lens as recited in claim 7, wherein the coupling
11 slot comprises a linear section.

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13 9. The electromagnetic lens as recited in claim 7, wherein the
14 extrapolated curve section of the curvilinear output reflector is related to the multi-
15 foci extrapolated curved section of the curvilinear input reflector such that an
16 electromagnetic wave emanating from at least one input probe of the plurality of
17 input probes that is reflected from the curvilinear input reflector and directed
18 through the coupling slot via the curvilinear coupling wall presents a linear phase
19 front at the plurality of output probes after reflection from the curvilinear output
20 reflector.

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22 10. The electromagnetic lens as recited in claim 7, wherein the multi-
23 foci extrapolated curved section provides a plurality of foci via a plurality of foci
24 zones that are interconnected via a plurality of extrapolation zones.

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1 **11.** The electromagnetic lens as recited in claim 10, wherein the
2 plurality of foci comprises three, four, or five foci.

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4 **12.** The electromagnetic lens as recited in claim 1, wherein the input
5 section is formed, at least partially, from an input plate and a common plate that
6 are substantially parallel to each other.

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8 **13.** The electromagnetic lens as recited in claim 12, wherein the input
9 section is also formed from at least part of an input spacer, the input spacer
10 establishing the curvilinear input reflector.

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12 **14.** The electromagnetic lens as recited in claim 1, wherein the output
13 section is formed, at least partially, from a common plate and an output plate that
14 are substantially parallel to each other.

15
16 **15.** The electromagnetic lens as recited in claim 14, wherein the output
17 section is also formed from at least part of an output spacer, the output spacer
18 establishing the curvilinear output reflector.

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20 **16.** The electromagnetic lens as recited in claim 1, wherein the coupling
21 slot comprises a gap and includes at least one bridge that extends across the gap
22 for mechanical stability of the electromagnetic lens.

1 **17.** The electromagnetic lens as recited in claim 1, wherein the coupling
2 slot enables electromagnetic waves to be coupled from the input section to the
3 output section.

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5 **18.** The electromagnetic lens as recited in claim 1, wherein the
6 electromagnetic lens is configured so that: an electromagnetic wave emanating
7 from at least one input probe of the plurality of input probes is guided along the
8 input section to the coupling section, the electromagnetic wave is directed from
9 the input section through the coupling slot to the output section, and the
10 electromagnetic wave is guided along the output section to the plurality of output
11 probes.

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13 **19.** The electromagnetic lens as recited in claim 18, wherein the
14 electromagnetic lens is further configured such that: the electromagnetic wave is
15 guided along the input section from the plurality of input probes using the
16 curvilinear input reflector, the electromagnetic wave is coupled from the input
17 section to the output section via the coupling slot using the curvilinear coupling
18 wall of the coupling section, and the electromagnetic wave is guided along the
19 output section to the plurality of output probes using the curvilinear output
20 reflector.

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22 **20.** The electromagnetic lens as recited in claim 1, wherein the plurality
23 of input probes comprises six input probes.
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1 **21.** The electromagnetic lens as recited in claim 1, wherein the plurality
2 of output probes comprises eight output probes.

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4 **22.** The electromagnetic lens as recited in claim 1, wherein the plurality
5 of input probes are proximate to the curvilinear input reflector, and the plurality of
6 output probes are proximate to the curvilinear output reflector.

7
8 **23.** The electromagnetic lens as recited in claim 1, wherein the input
9 section, the output section, and the coupling section comprise at least one
10 electromagnetic medium.

11
12 **24.** The electromagnetic lens as recited in claim 23, wherein the at least
13 one electromagnetic medium comprises air.

14
15 **25.** The electromagnetic lens as recited in claim 23, wherein the at least
16 one electromagnetic medium comprises a non-air dielectric.

1 **26.** An access station comprising:

2 a lens including:

3 an input section including a plurality of input probes and a
4 curvilinear input reflector;

5 an output section including a plurality of output probes and a
6 curvilinear output reflector; and

7 a coupling section including a coupling slot and a curvilinear
8 coupling wall.

9
10 **27.** The access station as recited in claim 26, further comprising:

11 an antenna array that is coupled to the plurality of output probes.

12
13 **28.** The access station as recited in claim 27, wherein the antenna array
14 includes a plurality of antenna elements; and wherein each respective antenna
15 element of the plurality of antenna elements is coupled to a respective output
16 probe of the plurality of output probes.

17
18 **29.** The access station as recited in claim 28, wherein the plurality of
19 antenna elements and the plurality of output probes both number eight.

20
21 **30.** The access station as recited in claim 26, further comprising:

22 one or more signal processors that are coupled to the plurality of input
23 probes.

1 **31.** The access station as recited in claim 30, wherein the one or more
2 signal processors include a plurality of processor interfaces; and wherein each
3 respective processor interface of the plurality of processor interfaces is coupled to
4 a respective input probe of the plurality of input probes.

5
6 **32.** The access station as recited in claim 31, wherein the plurality of
7 processor interfaces and the plurality of input probes both number six.

8
9 **33.** The access station as recited in claim 26, wherein the access station
10 comprises a Wi-Fi switch.

11
12 **34.** The access station as recited in claim 26, wherein the access station
13 operates in accordance with at least one IEEE 802.11 standard.

14
15 **35.** The access station as recited in claim 26, wherein the curvilinear
16 input reflector comprises a non-circular conic section, the curvilinear output
17 reflector comprises a linear section, and the curvilinear coupling wall comprises a
18 parabolic section.

19
20 **36.** The access station as recited in claim 26, wherein the curvilinear
21 input reflector comprises a multi-foci extrapolated curved section, the curvilinear
22 output reflector comprises an extrapolated curve section that is related to the
23 multi-foci extrapolated curved section of the curvilinear input reflector, and the
24 curvilinear coupling wall comprises a linear section.

1 **37.** The access station as recited in claim 26, wherein the lens is
2 configured so that: an electromagnetic wave emanating from at least one input
3 probe of the plurality of input probes is guided along the input section to the
4 coupling section, the electromagnetic wave is directed from the input section
5 through the coupling slot to the output section, and the electromagnetic wave is
6 guided along the output section to the plurality of output probes.

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8 **38.** The access station as recited in claim 37, wherein the lens is further
9 configured such that: the electromagnetic wave is guided along the input section
10 from the plurality of input probes using the curvilinear input reflector, the
11 electromagnetic wave is coupled from the input section to the output section via
12 the coupling slot using the curvilinear coupling wall of the coupling section, and
13 the electromagnetic wave is guided along the output section to the plurality of
14 output probes using the curvilinear output reflector.

15
16 **39.** An electromagnetic lens comprising:
17 an input section including a plurality of input probes and a curvilinear input
18 reflector having a non-circular conic section;
19 an output section including a plurality of output probes and a linear output
20 reflector; and
21 a coupling section including a coupling slot and a curvilinear coupling wall
22 having a parabolic section.

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1 **40.** The electromagnetic lens as recited in claim 39, wherein the
2 parabolic section of the curvilinear coupling wall is concave and capable of
3 collimating rays of a propagating electromagnetic wave.

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5 **41.** The electromagnetic lens as recited in claim 39, wherein the
6 coupling slot comprises a parabolic section.

7
8 **42.** The electromagnetic lens as recited in claim 39, wherein the non-
9 circular conic section of the curvilinear input reflector comprises at least one of a
10 hyperbolic section, an elliptical section, and a parabolic section.

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12 **43.** The electromagnetic lens as recited in claim 42, wherein the non-
13 circular conic section is at least one of convex and concave.

14
15 **44.** The electromagnetic lens as recited in claim 39, wherein the non-
16 circular conic section of the curvilinear input reflector comprises a convex
17 hyperbolic section.

1 **45.** An electromagnetic lens comprising:
2 an input plate;
3 an output plate;
4 a common plate having a coupling slot, the common plate located between
5 the input plate and the output plate;
6 an input spacer having a hyperbolic input reflector and a parabolic input
7 coupling wall, the input spacer located between the input plate and the common
8 plate;
9 an output spacer having a linear output reflector and a parabolic output
10 coupling wall, the output spacer located between the output plate and the common
11 plate;
12 at least one input probe located between the input plate and the common
13 plate; and
14 one or more output probes located between the output plate and the
15 common plate.

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17 **46.** The electromagnetic lens as recited in claim 45, wherein the at least
18 one input probe and the one or more output probes are secured to opposite sides of
19 the common plate.

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21 **47.** The electromagnetic lens as recited in claim 45, wherein the at least
22 one input probe is located one-quarter wavelength away from the hyperbolic input
23 reflector, and the one or more output probes are located one-quarter wavelength
24 away from the linear output reflector.

1 **48.** The electromagnetic lens as recited in claim 45, wherein the
2 hyperbolic input reflector is convex, and the input and output coupling walls are
3 concave.
4

5 **49.** The electromagnetic lens as recited in claim 45, wherein the input
6 spacer is in contact with the input plate and the common plate, and the output
7 spacer is in contact with the output plate and the common plate.
8

9 **50.** The electromagnetic lens as recited in claim 45, wherein the input
10 plate, the input spacer, the common plate, the output spacer, and the output plate
11 are fastened together using at least one of rivets, screws, and bolts.
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13 **51.** The electromagnetic lens as recited in claim 45, wherein the input
14 plate is substantially parallel to the common plate, and the common plate is
15 substantially parallel to the output plate.
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17 **52.** The electromagnetic lens as recited in claim 45, wherein the input
18 plate, the input spacer, the common plate, the output spacer, and the output plate
19 are at least one of integrated together and separate from each other.
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1 **53.** An electromagnetic lens comprising:
2 a first layer;
3 a second layer adjacent to the first layer; the second layer including a
4 plurality of input probes, a curvilinear input reflector, and a first curvilinear
5 coupling wall;
6 a third layer adjacent to the second layer, the third layer including a
7 coupling slot;
8 a fourth layer adjacent to the third layer; the fourth layer including a
9 plurality of output probes, a curvilinear output reflector, and a second curvilinear
10 coupling wall; and
11 a fifth layer adjacent to the fourth layer.

12
13 **54.** The electromagnetic lens as recited in claim 53, wherein the first
14 layer and the third layer form an electromagnetic waveguide at the second layer;
15 and wherein the third layer and the fifth layer form another electromagnetic
16 waveguide at the fourth layer.

17
18 **55.** The electromagnetic lens as recited in claim 53, wherein the
19 curvilinear input reflector comprises a non-circular conic section, the curvilinear
20 output reflector comprises a linear section, and each of the first and second
21 curvilinear coupling walls comprises a parabolic section.

1 **56.** The electromagnetic lens as recited in claim 53, wherein the
2 curvilinear input reflector comprises a multi-foci extrapolated curved section, the
3 curvilinear output reflector comprises an extrapolated curve section that is related
4 to the multi-foci extrapolated curved section of the curvilinear input reflector, and
5 each of the first and second curvilinear coupling walls comprises a linear section.
6

7 **57.** The electromagnetic lens as recited in claim 53, wherein the
8 electromagnetic lens is configured so that: an electromagnetic wave emanating
9 from at least one input probe of the plurality of input probes is guided along the
10 second layer between the first and third layers to the coupling slot, the
11 electromagnetic wave is directed through the coupling slot from the second layer
12 to the fourth layer, and the electromagnetic wave is guided along the fourth layer
13 between the third and fifth layers to the plurality of output probes.
14

15 **58.** The electromagnetic lens as recited in claim 57, wherein the
16 electromagnetic lens is further configured such that: the electromagnetic wave is
17 guided along the second layer from the plurality of input probes using the
18 curvilinear input reflector, the electromagnetic wave is coupled from the second
19 layer to the fourth layer via the coupling slot using the first and second curvilinear
20 coupling walls, and the electromagnetic wave is guided along the fourth layer to
21 the plurality of output probes using the curvilinear output reflector.
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1 **59.** The electromagnetic lens as recited in claim 57, wherein the
2 electromagnetic lens is further configured such that: the electromagnetic wave is
3 redirected approximately 180° by a combination of the first curvilinear coupling
4 wall, the coupling slot, and the second curvilinear coupling wall.

5
6 **60.** An access station comprising:

7 a lens including:

8 a first layer;

9 a second layer adjacent to the first layer; the second layer including a
10 plurality of input probes, a curvilinear input reflector, and a first curvilinear
11 coupling wall;

12 a third layer adjacent to the second layer, the third layer including a
13 coupling slot;

14 a fourth layer adjacent to the third layer; the fourth layer including a
15 plurality of output probes, a curvilinear output reflector, and a second
16 curvilinear coupling wall; and

17 a fifth layer adjacent to the fourth layer.

18
19 **61.** The access station as recited in claim 60, wherein at least one of the
20 first layer, the second layer, the third layer, the fourth layer, and the fifth layer is
21 not integrated with another layer.

1 **62.** The access station as recited in claim 60, wherein at least one of the
2 first layer, the second layer, the third layer, the fourth layer, and the fifth layer is
3 integrated with another layer.

4
5 **63.** The access station as recited in claim 60, further comprising:
6 an antenna array that is coupled to the plurality of output probes and that
7 produces a plurality of communication beams;

8 wherein a first signal that is applied to a first input probe of the plurality of
9 input probes is produced on a first communication beam of the plurality of
10 communication beams, and a second signal that is applied to a second input probe
11 of the plurality of input probes is produced on a second communication beam of
12 the plurality of communication beams.

13
14 **64.** An electromagnetic lens comprising:
15 a first layer;
16 a second layer adjacent to the first layer; the second layer including a
17 plurality of input probes, a hyperbolic input reflector, and a first parabolic
18 coupling wall;

19 a third layer adjacent to the second layer, the third layer including a
20 parabolic coupling slot;

21 a fourth layer adjacent to the third layer; the fourth layer including a
22 plurality of output probes, a linear output reflector, and a second parabolic
23 coupling wall; and

24 a fifth layer adjacent to the fourth layer.
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1 **65.** The electromagnetic lens as recited in claim 64, wherein the first
2 layer is substantially parallel to the third layer, and the third layer is substantially
3 parallel to the fifth layer.

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5 **66.** The electromagnetic lens as recited in claim 64, wherein the third
6 layer further includes at least one bridge that extends across a gap of the parabolic
7 coupling slot.

8
9 **67.** An electromagnetic lens comprising:
10 a first layer;
11 a second layer adjacent to the first layer; the second layer including a
12 plurality of input probes, a multi-foci extrapolated curved reflector, and a first
13 linear coupling wall;
14 a third layer adjacent to the second layer, the third layer including a linear
15 coupling slot;
16 a fourth layer adjacent to the third layer; the fourth layer including a
17 plurality of output probes, an extrapolated curved reflector that is related to the
18 multi-foci extrapolated curved reflector, and a second linear coupling wall; and
19 a fifth layer adjacent to the fourth layer.

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1 **68.** The electromagnetic lens as recited in claim 67, wherein the
2 extrapolated curved reflector is related to the multi-foci extrapolated curved
3 reflector such that an electromagnetic wave (i) that emanates from at least one
4 input probe of the plurality of input probes and (ii) that is reflected from the multi-
5 foci extrapolated curved reflector and redirected through the linear coupling slot
6 via the first and second linear coupling walls presents a linear phase front at the
7 plurality of output probes after reflection from the extrapolated curved reflector.

8
9 **69.** The electromagnetic lens as recited in claim 67, wherein the multi-
10 foci extrapolated curved reflector establishes a plurality of foci via a plurality of
11 foci zones that are interconnected by a plurality of extrapolation zones.

12
13 **70.** The electromagnetic lens as recited in claim 67, wherein the linear
14 coupling slot is proximate to the first and second linear coupling walls.

15
16 **71.** A method for an access station comprising:
17 emanating an electromagnetic wave from an input probe;
18 guiding the electromagnetic wave toward a coupler using a hyperbolic
19 reflector;
20 collimating the electromagnetic wave at the coupler using a parabolic wall;
21 guiding the electromagnetic wave from the coupler toward a plurality of
22 output probes; and
23 collecting the electromagnetic wave at the plurality of output probes using a
24 linear reflector.
25

1 **72.** A method for an access station comprising:
2 emanating an electromagnetic wave from an input probe;
3 guiding the electromagnetic wave toward a coupler using a curvilinear
4 input reflector;
5 redirecting the electromagnetic wave at the coupler using a curvilinear
6 coupling wall;
7 guiding the electromagnetic wave from the coupler toward a plurality of
8 output probes; and
9 collecting the electromagnetic wave at the plurality of output probes using a
10 curvilinear output reflector.

11
12 **73.** The method as recited in claim 72, further comprising:
13 accepting an electromagnetic signal, which corresponds to the
14 electromagnetic wave, at the input probe from a signal processor.

15
16 **74.** The method as recited in claim 72, further comprising:
17 forwarding the electromagnetic wave or an electromagnetic signal
18 corresponding thereto from the plurality of output probes to an antenna array.

19
20 **75.** The method as recited in claim 74, further comprising:
21 producing a communication beam from the antenna array, the
22 communication beam carrying the electromagnetic wave or the electromagnetic
23 signal.

1 76. The method as recited in claim 72, wherein the collecting
2 comprises:

3 receiving the electromagnetic wave with a different phase at each
4 output probe of the plurality of output probes.

5
6 77. The method as recited in claim 76, wherein the receiving comprises:

7 receiving the electromagnetic wave with a linear phase front
8 at the plurality of output probes.

9
10 78. The method as recited in claim 72, wherein the redirecting
11 comprises:

12 redirecting the electromagnetic wave through a coupling slot at the
13 coupler.

1 79. The method as recited in claim 72, wherein:

2 the guiding the electromagnetic wave toward a coupler using a
3 curvilinear input reflector comprises guiding the electromagnetic wave
4 toward the coupler using the curvilinear input reflector that includes a non-
5 circular conic section;

6 the redirecting the electromagnetic wave at the coupler using a
7 curvilinear coupling wall comprises redirecting the electromagnetic wave at
8 the coupler using the curvilinear coupling wall that includes a parabolic
9 section; and

10 the collecting the electromagnetic wave at the plurality of output
11 probes using a curvilinear output reflector comprises collecting the
12 electromagnetic wave at the plurality of output probes using the curvilinear
13 output reflector that includes a linear section.

1 80. The method as recited in claim 72, wherein:

2 the guiding the electromagnetic wave toward a coupler using a
3 curvilinear input reflector comprises guiding the electromagnetic wave
4 toward the coupler using the curvilinear input reflector that includes a
5 multi-foci extrapolated curved section;

6 the redirecting the electromagnetic wave at the coupler using a
7 curvilinear coupling wall comprises redirecting the electromagnetic wave at
8 the coupler using the curvilinear coupling wall that includes a linear
9 section; and

10 the collecting the electromagnetic wave at the plurality of output
11 probes using a curvilinear output reflector comprises collecting the
12 electromagnetic wave at the plurality of output probes using the curvilinear
13 output reflector that includes an extrapolated curved section that is related
14 to the multi-foci extrapolated curved section of the curvilinear input
15 reflector.

1 **81.** A method for an access station comprising:
2 emanating an electromagnetic wave from an input probe;
3 guiding the electromagnetic wave toward a coupler using a multi-foci
4 extrapolated curved reflector;
5 redirecting the electromagnetic wave at the coupler using a linear coupling
6 wall and a coupling slot;
7 guiding the electromagnetic wave from the coupler toward a plurality of
8 output probes; and
9 collecting the electromagnetic wave at the plurality of output probes using
10 an extrapolated curved reflector that is related to the multi-foci extrapolated
11 curved reflector.

12
13 **82.** The method as recited in claim 81, wherein the collecting
14 comprises:

15 collecting the electromagnetic wave at the plurality of output probes
16 using the extrapolated curved reflector that is adapted with regard to the
17 multi-foci extrapolated curved reflector so as to establish a linear phase
18 relationship for the electromagnetic wave at the plurality of output probes.
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1 **83.** An arrangement for an access station comprising:
2 emanation means for emanating an electromagnetic wave;
3 collection means for collecting the electromagnetic wave;
4 first guidance means for guiding the electromagnetic wave from the
5 emanation means toward a curvilinear coupling wall using a curvilinear input
6 reflector;
7 second guidance means for guiding the electromagnetic wave from the
8 curvilinear coupling wall toward the collection means using a curvilinear output
9 reflector; and
10 coupling means for coupling the electromagnetic wave from the first
11 guidance means to the second guidance means using the curvilinear coupling wall.

12
13 **84.** The arrangement as recited in claim 83, wherein the arrangement is
14 configured such that the electromagnetic wave is collected by the collection means
15 with a plurality of time delays.

16
17 **85.** The arrangement as recited in claim 83, wherein the coupling means
18 for coupling the electromagnetic wave from the first guidance means to the second
19 guidance means using the curvilinear coupling wall is adapted to couple the
20 electromagnetic wave from the first guidance means to the second guidance means
21 via a coupling slot.